NOVEMBER/DECEMBER 2024

# FACS42/CACS42 — STATISTICAL METHODS AND THEIR APPLICATIONS — II

Shanmuga Industries Arts & Science College
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Time : Three hours Maximum : 75 marks

SECTION A — (10 × 2 = 20 marks)

Answer ALL the questions.

1. Write down the normal equations of curve $y = a + bx$.

2. Define curve fitting.

3. Prove that $P(A) = 1 - P(\overline{A})$, where $A$ is a subset of the sample space.

4. What is Boole's inequality?

5. Show that the characteristic function of binomial distribution is $(q + pe^{it})^n$.

6. Derive the mean of the Poisson distribution.

7. Define sample error.

8. What is t-distribution?

9. What is ANOVA test?

10. Write row totals and grand total formulas.

SECTION B — ($5 \times 5 = 25$ marks)

Answer ALL the questions.

11. (a) Fit a straight line to the following data and estimate the value of $y$ corresponding to $x = 6$.

| X | 0 | 5 | 10 | 15 | 20 | 25 |
|---|---|---|---|---|---|---|
| Y | 12 | 15 | 17 | 22 | 24 | 30 |

Or

(b) Fit the curve $y = bx^a$ to the following data :

| X | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| Y | 1200 | 900 | 600 | 200 | 110 | 50 |

19. Two random samples drawn from 2 normal populations are given below. Test whether the 2 populations have the same variance.

Sample I : 20 16 26 27 23 22 18 24 25 19

Sample II : 17 23 32 25 22 24 28 06 31 33 20 27

20. Analyse the variance in the following Latin square.

A8 C18 B9

C9 B18 A16

B11 A10 C20

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12. (a) State and prove Baye's Theorem.

Or

(b) X can hit a target 3 times in 5 shots ; Y can hit 2 times in 5 shots ; Z can hit 3 times in 4 shots. They fire a volley. What is the probability that 2 shots hit the target?

13. (a) If $X$ is normally distributed with mean 8 and S.D. 4 find :

(i) $P(5 \leq X \leq 10)$

(ii) $P(10 \leq X \leq 15)$

(iii) $P(X \geq 15)$.

Or

(b) Fit a Poisson distribution to the following data :

| X | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| F | 123 | 59 | 14 | 3 | 1 |

14. (a) A random sample of 10 boys has the following : I.Q. 70, 120, 110, 101, 88, 83, 95, 98, 107, 100. Do these data support the assumption of a population mean I.Q. of 100?

Or

(b) A die is thrown 10,000 times and a throw of 1 or 2 was obtained 4,200 times. On the assumption of random throwing do the data indicate an unbiased die?

15. (a) Explain the Randomized block design.

Or

(b) The following table gives the results of experiments on 4 varieties of crops in 5 blocks of plots. Prepare the table of analysis of variance to test the significance of difference between the yields of the 4 varieties. Discuss the Randomized block design.

| Block / Variety | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| A | 32 | 34 | 35 | 35 | 37 |
| B | 34 | 33 | 36 | 37 | 35 |
| C | 31 | 34 | 35 | 32 | 36 |
| D | 29 | 26 | 30 | 28 | 29 |



SECTION C — (3 × 10 = 30 marks)

Answer any THREE questions.

16. Fit a second degree parabola by taking $x_i$ as the independent variable.

| X | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Y | 1 | 5 | 10 | 22 | 38 |

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17. The contents of 3 Urns are Urn I : 1 white 3 red 2 black balls, Urn II : 3 white 1 red 1 black balls, Urn III : 3 white 3 red 3 black balls. Two balls are chosen from a randomly selected Urn. If the balls are 1 white and 1 red ball what is the probability that they come from Urn II?

18. Derive the mean and variance of the binomial distribution.